ed blossoms in the succeeding spring: this would, I do not doubt, have afforded fruit; but that, leaving my residence at Elton for this place, I removed my trees, and the whole of their blossoms in the last spring proved, in consequence, equally abortive.

On the parts of Trees primarily impaired by age. In a letter from T. A. Knight, F.R.S. to the Rt. Hon. Sir Joseph Banks, Bart. K.B.P.R.S.— From the Philosophical Transactions of the Royal Society of London.

In the first communication I had the honour to address to you, (it was in the year 1795), I stated the result of many experiments on grafted trees, from which I inferred that each variety can be propagated with success, during a limited period only; and that the graft, or other detached part of an old tree, or old variety, can never form that, which can with propriety be called a young tree.

I have subsequently endeavoured to ascertain which, amongst the various organs that compose a tree, first fails to execute its office, and thus tends to bring on the incurable debility of old age; and the result of the experiments appears sufficiently interesting, to induce me to communicate an account of them to you.

Whatever difference exists between the functions of animal and vegetable life, there is a very obvious analogy between some of the organs of plants, and those of animals; and it does not appear very improbable, that the correspondent organ, in each, may first fail to execute its office; and satisfactory evidence of the imperfect action of any particular organ can much more easily be obtained in the vegetable, than in the animal world.—For a tree may be composed, by the art of the grafter, of the detached parts of many others; and the defective, or efficient, operation, of each organ, may thus be observed with the greatest accuracy. But such observations cannot be made upon animals; because the operations necessary cannot be performed; and therefore, though there would be much danger of error in incautiously transferring the phenomena of one class of organized beings to another, I conceive that experiments on plants may be, in some cases, useful to the investigator of the animal economy. They may direct him in his pursuits, and possibly facilitate his inquiries into the immediate causes of the decay of animal strength and life; and on a subject of so much importance to mankind, no source of information should remain unexplored, and no lights, however feeble, be disregarded.

Naturalists, both of ancient and modern times, have considered the structure of plants, as an inversion of that of animals, and having compared the roots to the intestines, and the leaves to the lungs, of animals; and the analogy between the vegetable sap, and animal blood, is very close and obvious. The experiments also, of which I have at different periods communicated accounts to you, supported by the facts previously ascertained by other naturalists, scarcely leave any reasonable grounds of doubt, that the sap of trees circulates, as far as is apparently necessary to, or consistent with, their state of existence and growth.

The roots of trees, particularly those in coppices, which are felled at stated periods, continue so long to produce, and feed, a succession of branches, that no experiments were wanted to satisfy me, that it is

not any defective action of the root which occasions the debility and diseases of old varieties of the apple and pear tree; and indeed experience every where shows, that a young seedling stock does not give the character of youth to the inserted bud or graft. I, however, procured plants from cuttings of some very old varieties of the apple, which readily emit roots; and these plants at the end of two years were grafted, about two inches above the ground, with a new and very luxuriant variety of the same species. These grafts grew very freely, and the roots themselves, at the end of four or five years, probably contained at least ten times as much alburnum, as they would have contained, had the trees remained ungrafted. The roots were also free from every appearance of disease, or defect.

Some crab-stocks were at the same time grafted with the golden pippin, in a soil where the wood of that variety rarely lived more than two years; and I again grafted the annual shoots of the golden pippin, with cuttings of a young and healthy crab-tree, so as to include a portion of the wood of the golden pippin, between the roots and branches of the native uncultivated species, or crab-tree; and in this situation it grew just as well as the wood of the stock and branches. Some branches also of the golden pippin trees, which I mentioned in my former communication of 1795, being much cankered, were cut off about a foot above the junction of the grafts to the stocks, and were regrafted with a new and healthy variety. Parts of the wood of the golden pippin, in which were many cankered spots, were thus placed between the newly-inserted grafts, and the stocks; and these parts have subsequently become perfectly free from disease, and the wounds, previously made by canker, have been wholly covered with new and healthy bark. These facts, therefore, satisfied me, that the debility and diseases of old varieties of fruit of this species, did not originate in any defective action of the bark or alburnum, either of the root, or of the stem and branches, and my attention was constantly directed to the leaf and succulent animal shoot.

A few crab-stocks were grafted with cuttings of golden pippin, in a situation and soil, where I had previously ascertained that the wood of the golden pippin rarely remained in health at the end of a second year; and, as soon as the annual shoots had acquired sufficient growth and firmness, numerous buds of a new and luxuriant variety of apple, which had recently sprung from seed, were inserted in them. During the succeeding winter the natural buds of the golden pippin branches were destroyed, and those inserted suffered alone to remain; and as soon as the leaves of these had unfolded, and entered on their office, every symptom of debility and disease disappeared in the bark and wood of the golden pippin; and each continued to perform its office, just as well as the wood and bark of the young seedling stocks could have done under similar circumstances.—I made nearly the same experiments on the pear tree, and with the same result.

I have endeavoured, in several former communications, to prove that the sap of plants circulates through their leaves, as the blood of animals circulates through their lungs; and I have not subsequently found any facts, in the writings of other naturalists, or in my own experiments, which militate against this conclusion. I have also observed, that grafted trees, of old and debilitated va-

rieties of fruit, became most diseased in rich soils, and when grafted on stocks of the most vigorous growth; which has induced me to suspect, that in such cases more food is collected, and carried up into the plant, than its leaves can prepare and assimilate, and that the matter thus collected, which would have promoted the health and growth in a vigorous variety, accumulates, and generates disease in the extremities of the branches and annual shoots, whilst the lower part of the trunk and roots remain, generally, free from any apparent disease. I am, therefore, much disposed to attribute the diseases and debility of old age in trees, to inability to produce leaves, which can efficiently execute their natural office; and to some consequent imperfection in the circulating fluid. It is true that the leaves are annually reproduced, and therefore, annually new; but there is, I conceive, a very essential difference between the new leaves of an old, and of a young variety: and in support of this opinion, I shall observe, that the external character of the leaf of the same variety at two, and at twenty years old, is very dissimilar; and it therefore appears not improbable, that further changes will have taken place at the end of two centuries*.

*The leaf of a seedling apple or pear-tree, when the plant is very young, is generally almost wholly free from the pubescence or down, which subsequently appears on its under surface; and which Bonnet and M. Mirbel, have supposed to increase its surface and powers. But I feel little disposed to adopt this hypothesis, having observed that the leaves of some new varieties of the apple, which have sprung from seeds of the Siberian crab, have both surfaces nearly equally smooth; and that these varieties grow faster, and bear heavier crops of very rich fruit, than any others, without being exhausted or injured.

If these opinions be well founded, and the leaves of trees be analogous to the lungs of animals, is it very improbable that the natural debility of old age of trees and of animals, may originate from a similar source?—This is a question, upon which I am not by any means prepared to give an opinion: but I believe it will very generally be admitted, that the human subject is best formed for long life, when the chest is best formed to permit the lungs to move with most freedom. I have also long and attentively observed amongst our domesticated animals, that those individuals longest retain their health and strength, and best bear excessive labour and sufficient food, in which the chest is most deep and capacious, proportionately to the length of current the circulating fluid has to run; and the same remark will, I believe, be generally found applicable to the human species.

French Turnip; a variety of the Brassica Napus, or Rape which has long been cultivated upon the continent; by Mr. James Dickson, F.L.S. V.P.H.S.

Trans. Hart. Soc. vol. I.—26.

For above twelve years, I have seen this plant brought to our market in Covent Garden, but only by one person, and I believe it has been chiefly sold to foreigners, though, when once known, it will be a very acceptable root in most families. It is much more delicate in flavour than our common turnip, and is to be used in the same way. In Germany it enriches all their soups, and there is no necessity to cut away the outer skin, or rind, which is thinner than that of the common turnip, but only to scrape it. Stewed in gravy, it forms a most excellent dish, and being white,